DIGITAL TIME SWITCH- *Astro*™

Cat. Nos.: T2DDT0
T3DDT0

CE
RoHS ✓

SAFETY NOTICE:

1. Only qualified persons are authorized to install the ASTRO.
2. Automation and control devices must be installed so that they are protected against any risk of involuntary actuation.
3. It is essential to ensure that all control system connections meet applicable safety standards.
4. Fluctuations or variations in the mains supply voltage should not exceed the tolerance stated thresholds.

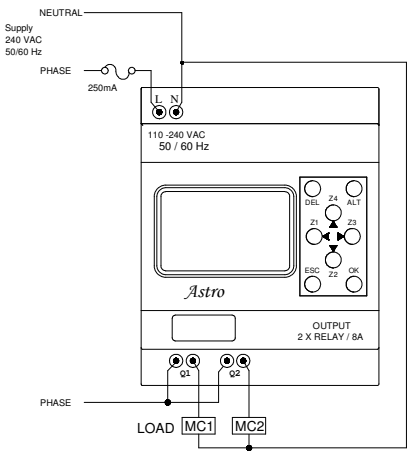
"**Astro**" is an astronomical time switch specifically designed for lighting applications. One can program the ASTRO to turn ON and turn OFF the light with reference to the sunrise and sunset. R, Y, B inputs can be looped to address single phase distribution or independently given to control 3 phase distributions. Relay channels can be independently programmed for ON or OFF operation by specifying the time offset with reference to sunrise and sunset or twilight rise and set.

CONNECTION DETAILS:

To connect Astro to PC using Serial or USB port: Astro has TTL Serial Port. Use TTL to RS232 cable [GFDNN2S] or USB cable [GFDNN1] for communication between Astro & PC.

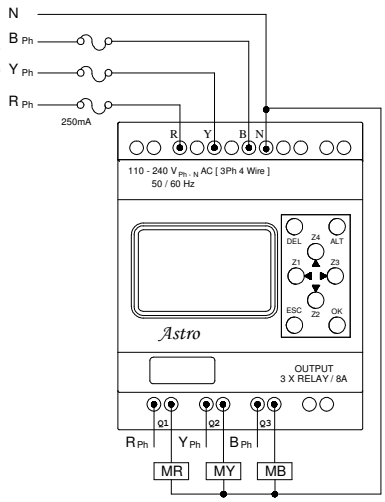
To connect Astro in RS485 network: Use standard isolated RS232 to RS485 2W/4W converter with Automatic flow control to connect in RS485 network. Connect TTL to RS232 cable [GFDNN2S] to the Astro.

Single Phase Astro:



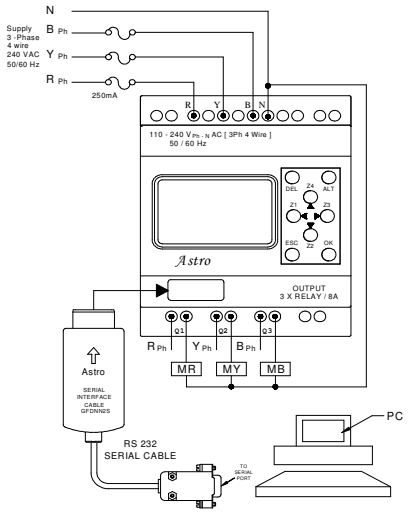
1. MC1 : - Coil of Contactor 1
2. MC2 : - Coil of Contactor 2

Three Phase Astro:



1. MR: - Coil of Contactor 1
2. MY: - Coil of Contactor 2
3. MB : - Coil of Contactor 3

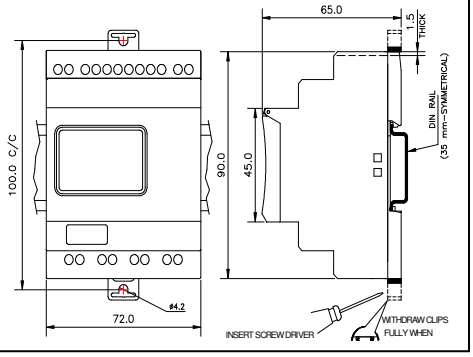
Three Phase Astro with Communication Cable:
Cable can be used to monitor channels or diagnostic status through PC side software or Modbus.



BASIC FEATURES:

- **Trigger Modes:** The time settings of all outputs can either be based on sunrise/sunset or twilight. The trigger mode SRISE/SET will provide the reference time from sunrise/sunset, while the trigger mode TWILIGHT will provide the reference time from start/end of twilight. To set this feature, refer page 3-> Screen tagged as '6'.
- **Operating Modes:** ASTRO has three operating modes ON, OFF, and PULSE. An 'ON' or 'OFF' op-mode causes an output to be turned 'ON' or 'OFF' with respect to sunrise/sunset. A 'PULSE' op-mode is to be used to have an output ON for few seconds from a particular time. To set this feature, refer page 3-> Screen tagged as '2'.
- **Offset:** It may be necessary to have an output action before or after some time of sunrise/sunset. This Offset from sunrise/sunset can be achieved using OFFSET feature of the ASTRO. ASTRO allows offset up to +/- 10:59. To set this feature, refer page 3-> Screen tagged as '1'.
- **Off-Hours:** This feature is to turn off any output for a particular time period. Maximum 23 hours of Off-hours can be set individually for every output. For example, off-hours from 23:00 to 2:00 will switch the output OFF for three hours everyday. To set this feature, refer page 3-> Screen tagged as '1'.
- **Alternate Mode:** In this mode, the Off-Hours feature is applied to alternate output on alternate days. This mode is useful to save energy due to off-hours feature and is useful to maximize load's life due to alternate action. For details, see Alternate mode details. To set this feature, refer page 3-> Screen tagged as '3'.
- **Weekly Off:** This feature automatically keeps off the output on weekly off day(s). However ASTRO allows to program weekly off day(s) and related begin/end time. This feature offers energy savings by switching an output OFF on weekly-off day(s). To set this feature, refer page 3-> Screen tagged as '1'.
- **Season Mode:** During rainy season or in cloudy atmosphere, sunlight may be insufficient. Hence different time offset needs be programmed to control light switching. User can program period of such season and the related time-offset. This feature helps switch lights early with respect to sun rise/set and automatically move back to original settings after the season period. To set this feature, refer page 3-> Screen tagged as '4'.
- **Day-light Saving Time (DST):** DST is the period in which clocks in certain countries are set one hour or more ahead of standard time to effectively use natural daylight. ASTRO provides settings to easily define DST start and end months and DST offset time to effectively manage the shifting of clock year after year without any manual intervention. To set this feature, refer page 3-> Screen tagged as '7'.
- **UV/OV Mode:** When Under / Over Voltage condition prevails, load can be tripped off thereby protecting load from damage due to extreme voltage irregularities. Users can set Under & Over Voltage as per their requirement. To set this feature, refer page 3-> Screen tagged as '5'.
- **Modbus Communication**: Three Phase version of Astro supports Modbus RTU communication protocol to read coil status, write or override coils, set season periods etc. from SCADA software. Modbus related information is mentioned on page 2. To set this feature, refer page 3-> Screen tagged as '8'.

MECHANICAL DIMENSIONS:



MANUAL OVERRIDE MODES:

By default and on the field, the device is generally in "AUTO" mode shown on the screen as "Qn-A". But, for the purpose of maintenance or because of extremely bad weather conditions for forceful switching, user has an option of four different override modes for output channel switching.

1. Manual OFF (T2DDT0): This override can be used to turn off the output channel forcefully. Once this override is selected, the output remains in OFF condition forever unless user selects another mode. This is valid even EUT is powered OFF and ON. The manual mode always overrides other operating mode. Shown on screen as "Qn-M x".

2. Manual ON (T2DDT0): This override can be used to turn on the output channel forcefully. Once this override is selected the output remains in ON condition forever unless user selects another mode. This is valid even EUT is powered OFF and ON. The manual mode always overrides other operating mode. Shown on screen as "Qn-M√".

3. Auto OFF (T2DDT0, T3DDT0): Used to turn OFF the output channel forcefully. But the OFF condition will not be forever. The device will automatically change the operating mode from Auto OFF to AUTO on next auto event. For example, user selects Auto OFF at 4:00 A.M. and device has OFF event at 7:00 A.M. The EUT will switch OFF from 4:00 A.M. to 7:00 A.M. Device will automatically shift to AUTO mode at 7:00 A.M. which is next auto event and remain OFF till next ON event. Shown on screen as "Q1-Ax".

4. Auto ON (T2DDT0, T3DDT0): Used to turn ON the output channel forcefully. The ON condition will not be forever. The EUT will change the operating mode to AUTO on next auto event. For example, user selects Auto ON at 4:00 P.M. and EUT has OFF event at 6:00 P.M. The EUT will remain ON from 4:00 P.M. to 6:00 P.M. and become OFF at 6:00 P.M because device will automatically shift to AUTO mode at 6:00 P.M. which is next auto event. Shown on screen as "Q1-A√".

Changing Operating Mode: To override the operating mode of output channel Q1 - Press Z1 [Q2 –Press Z2, Q3-Press Z3] key on the RUN screen. On every Z1 key press event, the operating mode changes.

Specifications	Single Phase	Three Phase
Product Code	T2DDT0	T3DDT0
Supply Voltage (Un)	110 – 240 VAC [-20% to +15%], 50/60 Hz	
Power Consumption	8 VA @ 300 VAC	
Storage Temperature	-10 °C to +60 °C	
Operating Temperature	-10 °C to +50 °C	
Switching Contacts	2	3
Contact Rating	8A (Res.) @ 240 VAC and 5A (Res.) @ 30 VDC	
Utilization Category	AC-15 and DC-13	
Power Reserve (For Clock Only)	1000 h	
Shortest Switching Time (Daily)	1 Minute	
Clock Deviation (max)	+/- 1 second per day over the operating temperature range	
Geographical Co-ordinates	Resolution 1°1´	
DST	Settable	
Manual Override	Provided. Use keys on keypad.	
Display	Backlit LC Graphics display for diagnostic view	
Under/Over Voltage (UV/OV) trip value	Not Applicable	Settable UV: 0–220V And OV: 130–330V
Trip Time for UV/OV	Not Applicable	5-16 seconds
Recovery Time	Not Applicable	1-4 seconds
Mounting	Base/ DIN Rail	
Dimension (in mm)	72 X 90 X 67	
Weight (Unpacked)	190 g	208 g

EMC tests	
Harmonic Current Emissions	IEC 61000-3-2 Ed. 3.0 (2005-11) Class A
ESD	IEC 61000-4-2 Ed. 1.2 (2001-04) Level II
Radiated Susceptibility	IEC 61000-4-3 Ed. 3.0 (2006-02) Level III
Electrical Fast Transients	IEC 61000-4-4 Ed. 2.0 (2004-07) Level IV
Surge	IEC 61000-4-5 Ed. 2.0 (2005-11) Level IV
Conducted Susceptibility	IEC 61000-4-6 Ed. 2.2 (2006-05) Level III
Voltage Dips and Interruption (AC)	IEC 61000-4-11 Ed. 2.0 (2004-03) All 7 Levels
Conducted Emission	CISPR 14-1 Ed. 5.0 (2005-11) Class A
Radiated Emission	CISPR 14-1 Ed. 5.0 (2005-11) Class A
Safety	
Test Voltage between I/P and O/P	IEC 60947-5-1 Ed. 3.0 (2003-11) 2 kV
Test Voltage between all terminals and enclosure	IEC 60947-5-1 Ed. 3.0 (2003-11) 4 kV
Impulse Voltage between I/P and O/P	IEC 60947-5-1 Ed. 3.0 (2003-11) Level IV
Single Fault	IEC 61010-1 Ed. 2.0 (2001-02)
Insulation Resistance	UL 508 Ed. 17 (1999-01) 2000 MΩ
Leakage Current	UL 508 Ed. 17 (1999-01) < 3.5 mA
Environmental testing	
Cold Heat	IEC 60068-2-1 Ed. 6.0 (2007-03)
Dry Heat	IEC 60068-2-2 Ed. 5.0 (2007-07)
Vibration	IEC 60068-2-6 Ed. 7.0 (2007-12) 5 g
Repetitive Shock	IEC 60068-2-27 Ed. 4.0 (2008-02) 40 g, 6 ms
Non-repetitive Shock	IEC 60068-2-27 Ed. 4.0 (2008-02) 30 g, 15 ms

Degree of Protection:
IP-20 for Terminals;
IP-40 for Enclosure

Pollution Degree: II

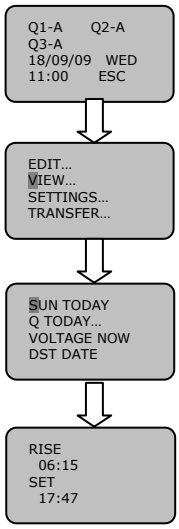
Terminology used in this leaflet:
Under Voltage is voltage below which load will become OFF.

Over Voltage is voltage above which load will become OFF.

Once Load becomes OFF due to Under Voltage condition, it will become ON only when Voltage becomes = (Under Voltage + Hysterisis). If Load becomes OFF due to Over Voltage condition, it will become ON only when Voltage becomes = (Over Voltage - Hysterisis). Hysterisis is kept as 15 Volts. This is to avoid chattering of contactor.

Appendix A – Selecting a required menu

This section describes how to select a menu. The menu selection is required either for selecting a sub-menu or for viewing a functional block for setting parameters. The following example illustrates how to view today's sunrise/sunset.



1.At power ON this screen will be displayed. Press 'ESC' key to view main menu.

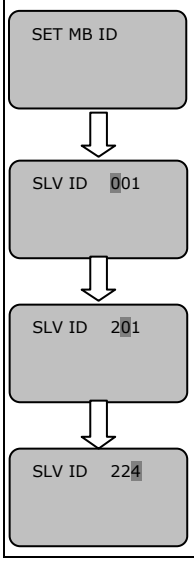
2. Press 'Z2' or 'Z4' key to move cursor to "VIEW" Menu. Then Press 'OK' key.

3. Press 'Z2' or 'Z4' key to move cursor to "SUN TODAY" Menu. Then Press 'OK' key

4. The Sunrise and set values will be displayed.

Appendix B - Setting the value of parameter

The following example illustrates the procedure to set the value of parameter in detail. This procedure can be used for setting any parameter in function block. Here the time zone value is to be set to +05:35.



1. When user selects "MODBUS CONFG" option from "TRANSFER" menu, this screen appears. Press OK to go the next screen.

2. This screen shows slave ID as 001. For example to set slave ID as 254, follow the steps 3 & 4.

3. Now cursor is on the first digit. Press 'ALT' key to edit that digit, then press 'Z2' or 'Z4' keys to change the digit. In order to make first digit as 2 so press Z2 twice. Then press 'OK' to save the change.

4. Now to move cursor to the next digit press 'Z3' key.
Repeat same procedure to change last two digits. After changing all digits press 'OK' to save settings.

You will again return to "SET MB ID" screen. Then Press 'ESC' until you return to the main screen.

MODBUS: Memory map:
Coil Status

Modbus Address	Parameters	Value	Modbus Address
00001	Relay 1 Status	1- On , 0- OFF	00001
00002	Relay 2 Status	1- On , 0- OFF	00002
00003	Relay 3 Status	1- On , 0- OFF	00003

Holding Registers

Modbus Address	Parameter	Value	Validation	Default Value
40001	Relay 1 Mode	00 - AUTO	0 to 4	0
		04 - Auto On		
		03 - Auto OFF		
40002	Relay 2 Mode	00 - AUTO	0 to 4	0
		04 - Auto On		
		03 - Auto OFF		
40003	Relay 3 Mode	00 - AUTO	0 to 4	0
		04 - Auto On		
		03 - Auto OFF		

Example 1: Read Status of coil 1, 2, 3 using Function 1[0x01].
Request to read coils 1-3 from slave device.
Slave modbus ID is 1.
Read coil function code is 1.
To read coil 1 - 3 modbus coil address is 0 -2.
Number of coils to be read is 3.
Query: 01, 01, 00, 00, 00, 03, CRC HI, CRC LO
Response: 01, 01, 01, 07, CRC HI, CRC LO
Here Data-07[111] i.e. Q3, Q2, Q1 are ON.

Example 2: Read mode of coil 1, 2, 3 using Function 3[0x03].
Slave modbus ID is 1.
Read holding register function code is 3.
Coil starting address 0
Number of coils to be read are 3.
Query: 01, 03, 00, 00, 00, 03, CRC HI, CRC LO
Response: 01, 03, 06, 00, 03, 00, 00, 00, 04, CRC HI, CRC LO

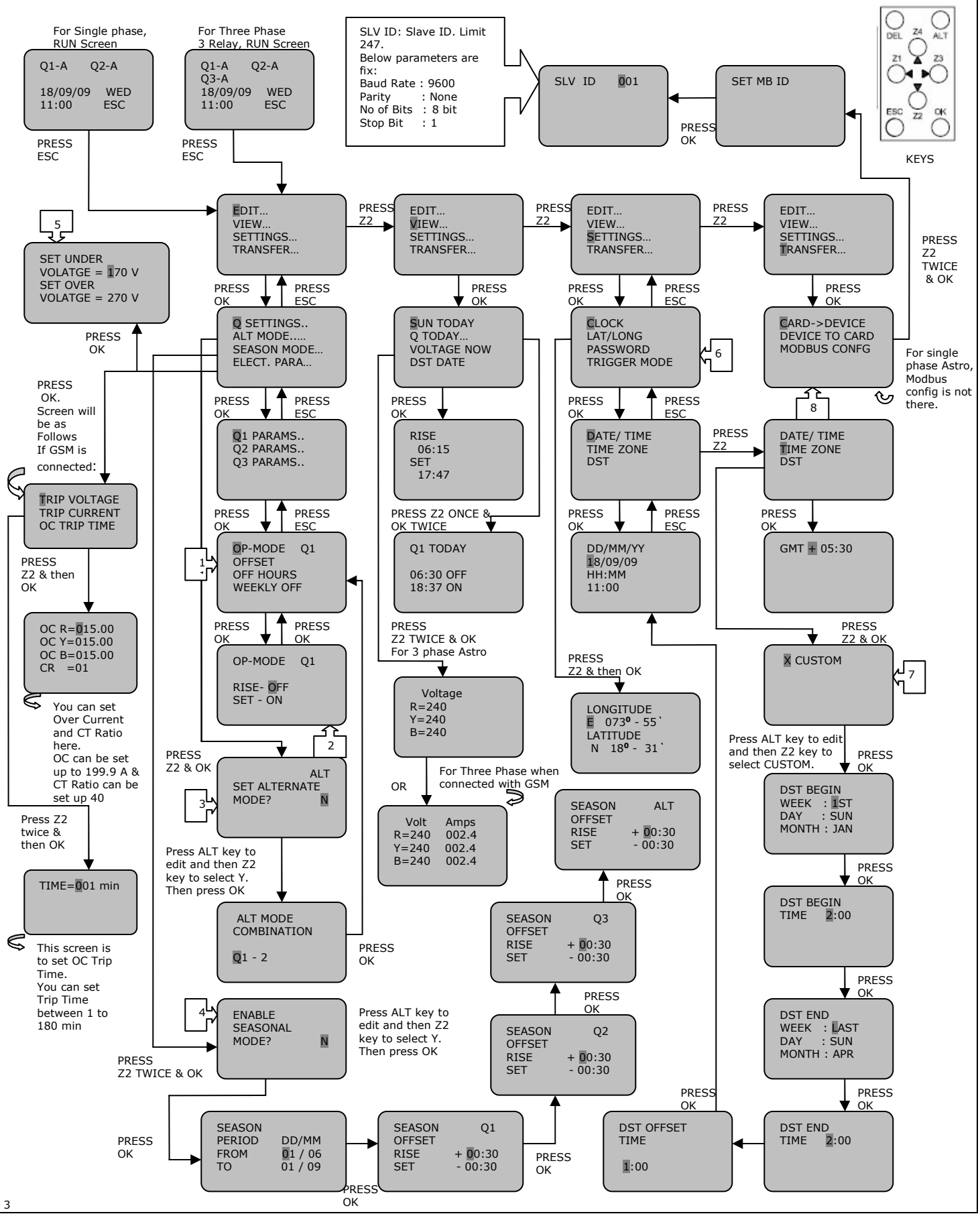
Example 3: Preset Single Register to change mode of coil 1, using Function 6[0x06].
To change Q1 status to Auto OFF mode
Slave modbus ID is 1.
Preset single register function code is 6.
Starting address 0.
Value to be written is 3.
Query: 01, 06, 00, 00, 00, 03, CRC HI, CRC LO.
Response: 01, 06, 00, 00, 00, 03, CRC HI, CRC LO.

Example 4: Preset Multiple Register to change mode of coils 1, 2, 3 using Function 16[0x10].
To change Q1, Q2, Q3 status.
Slave modbus ID is 1.
Preset Multiple Registers function code is 10.
Starting address is 0.
Values to be writing are 0, 3, and 4.
Query: 01, 10, 00, 00, 00, 03, 06, 00, 00, 00, 03, 00, 04, CRC HI, CRC LO.
Response: 01, 10, 00, 00, 00, 03, CRC HI, CRC LO.

Example 5: Get the description of the type of controller present at the slave address using Function 17[0x11].
Slave modbus ID is 1.
Report slave ID function code is 11.
Query: 01, 11, CRC HI, CRC LO.
Response: 01, 11, 0E, 30, 30, 2E, 31, 30, 2E, 30, 30, 32, AA, 01, 03, 03, 00, CRC HI, CRC LO.
Response Parameters –
Version String [4 to 12 bytes]:
Size of Version String = 9. In response device give ASCII values of version string.
Example: 00.03.000.
Manufacture code [13th byte] & Set feature code [14th byte]
Product Information [15th byte]: 00 - for single Phase Astro, 03 - for 3 Phase Astro.
Stabilizer Interface [16th byte]: 03- Stabilizer with 3 Phase Astro.
Reserved- [17th byte].

Note: For Modbus related DST and Season settings, refer help-file provided with Application Software- 'Astro-Soft'.

Note: For selecting a required menu refer Appendix A & for setting the value of parameter refer Appendix B



FAQ's:

Q. Astro's output (Load) is not switching ON.

→Please check whether you have set Under Voltage / Over-Voltage properly. Also check if the connection is as per given wiring diagram. Status of the Phases will be displayed on Screen in the event of phase Failure or Unhealthy condition (Over / Under Voltages).

Q. If one or two phase fails, will Astro work on remaining phase?

→Yes with 3 phase version, Product will work until last phase available. Suppose phase R and Y failed in Three Phase Astro then it will work on phase B. So output of only Q3 will be present.

Q. Is the light sensor needed for ASTRO time switch?

→No. Its switching is based on calculation of sunrise and sunset by programming date, time and local coordinates (Longitude & Latitude).

Q. Can I monitor Voltage of different phases?

→Yes, with the 3 phase version. You can monitor voltage on each phase which may help debugging. Press OK button on main Screen to view Voltages.

Q. Assume a setting on Astro having R ph OFF with Y ph & B ph as ON (in alternate mode as Q1-Q2-Q3). If due to any reason if Y or B Fails or Under/Over voltage occurred to Y or B phase, what will happen?

→In this case, Astro will automatically switch ON R ph & will switch OFF the faulty Phase. This will ensure Proper lighting.

Q. Can Three Phase Astro be used in Single Phase application?

→Yes for this, we have to loop (short) R, Y & B terminals & connect the phase.

Q. How can I use temporary ON feature e.g. Siren for 15 sec at Sunrise or Sunset?

→GO to Q1 or Q2 or Q3 settings according to the output you want to set Siren. Select "OP-MODE" as a "PULSE". Select "Pulse Duration" of 15 sec.

For changing output mode to Pulse refer page 3->screen tagged as 2.

Q. How can I transfer settings from PC to Device/ Device to PC?

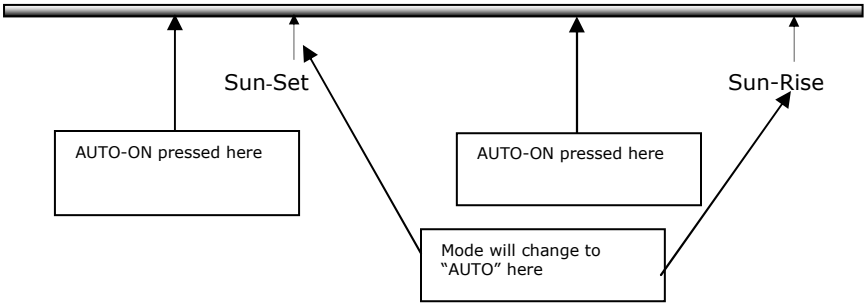
→ For this you can use application software "Astro-Soft" provided with the device. When you run the application software follow the steps as given below:

1. Select type of device from Device Type tab.
2. Select Country, State, City.
3. Select other settings as per requirements.
4. Connect TTL to RS232 cable [GFDNN2S] or USB cable [GFDNN1]. Refer Connection Details given on page 1.
5. Select CommPort under the Port Settings tab, Select require port.
6. Select "PC to Device" option under the Transfer tab to transfer settings to the Astro-unit.

OR to transfer settings from device to PC Select "Device to PC" option under the Transfer tab to transfer settings from Astro-unit to PC.

Q. What are AUTO-ON / AUTO-OFF modes?

→AUTO-ON: - When this mode is enabled, relay will switch ON instantaneously irrespective of program & will shift automatically into AUTO/Program mode during the next event. Now if you press AUTO-ON before sun-set, then Relay will be ON. Now next event is sun-set. So on sun-set, mode will be changed to "AUTO" again. Also note that Relay condition (ON/OFF) will depend on Program settings. AUTO-OFF working in a similar way. Only difference is Relay will be instantaneously OFF up to next event. In case of unhealthy condition on phase, device will automatically resume AUTO Mode. For e.g. You have made AUTO-ON for Relay coil Q1 (R phase) & if unhealthy power condition (Over/Under/ No Voltages) comes then AUTO-ON mode is converted in to AUTO Mode.



Q. I want to use the same program at different stations. Is there an option for copying a program from a unit to the other unit?

→ Yes, you can make use of the accessory: Memory Card. Just insert the memory card inside the slot provided in the unit. Press ESC to go to the EUT MENU. Select TRANSFER. Select "DEVICE->CARD" option in the unit. Thus, the program in your Astro-unit is stored into the Memory Card. Then you can insert the same card into other unit and follow the same steps explained above for another unit which is at different station. But instead of "DEVICE->CARD" option select and use "CARD->DEVICE" option. Thus programs in both Astro-units will be same as required in your application.

Q. I want to switch a load ON/OFF after/before one hour from Sunrise/Sunset. What should I do?

→ Use Offset feature and set the offset time as one hour from Sunrise/Sunset. To use offset feature, go to the EDIT->Q SETTINGS->Q1 OR Q2 OR Q3 PARAMS->OFFSET in Astro. Set Offset time as '+/- 01:00' for sunrise & Sunset by using 'Z' keys. Or you can transfer same settings from Astro-Soft to device.

Q. In case of three phase connection, is there any relationship between input supply & output relay?

→ Yes. R phase corresponds to output Q1, Y phase corresponds to output Q2, B phase corresponds to output Q3 Please note that, R phase should be applied to 'R' terminal, Y phase should be applied to 'Y' terminal & B phase should be applied to 'B' terminal.

TERMINAL DETAILS:

Ø3.5 mm	0.54 N.m (5 Lb.in) Terminal screw - M2.5
	1 x 0.2...3.3 mm² Solid Wire / Single Wire Ferrule
	2 x 0.2...1 mm² Insulated Twin Wire Ferrule
AWG	1 x 24 to 12